The system adopted is as follows:—The course of training extends over six years. The first two years are spent entirely at college; during the next two years, six months of each year are spent at college and six months in the practice of that particular branch which the student may select; the last two years are spent entirely in practical work. The system of instruction in the college is partly professorial and partly tutorial, consisting in the delivery of lectures and in assistance being given to the students in their work.

Candidates for admission must be Japanese subjects under the age of twenty, and must pass a preliminary examination, the best fifty being chosen as cadets, of which there are two classes. A student may elect to enter either as a Government cadet—in which case all his expenses are defrayed by Government, under whom he binds himself to serve for seven years at the expiration of his six years' training—or he may enter as a private cadet, paying his own expenses, in which case the obligation to serve subsequently under Government is dispensed with. In all other respects he is on the same footing as the Government cadet.

The whole system of training may be divided into three courses:—(1) General and Scientific, (2) Technical, and (3) Practical. The general and scientific course, which is taught during the first two years, includes (1) English language and composition, (2) geography, (3) elementary mathematics, (4) elementary mechanics, (5) elementary physics, (6) chemistry, and (7) mechanical drawing.

The Technical course consists of the following branches of engineering:—(1) Civil engineering, (2) mechanical engineering, (3) telegraphy, (4) architecture, (5) chemistry and metallurgy, and (6) mining. This course is taught during the third and fourth years of the curriculum. The practical course, in which the students are engaged during the last two years in the practice of the special branch each may have selected, consists of working in the laboratories of the college, and in the engineering works connected with it established at Akabane, where they serve a regular engineering apprenticeship. While this course is going on lectures on special subjects are given, and the students are required to prepare reports upon the work in which they have been engaged.

In the Technical course are included the higher mathematics and natural philosophy, engineering, civil and mechanical, geology, mineralogy, surveying, naval architecture, strength of materials, practice in the chemical, physical, metallurgical, and engineering laboratories, and in the drawing office and workshops.

The main building, which is a very handsome structure, consists of a central portion containing the large examination hall and library, drawing offices and class rooms, and on each side of this extends a wing containing other class rooms and lecture halls. This is the College proper, and surrounding it are separate buildings set apart for the dormitories, Professors' houses, museum and laboratories of which there are four devoted respectively to chemistry, physics, metallurgy, and engineering. The buildings have been very admirably arranged by the Principal of the College, Mr. Henry Dyer, C.E., and the architectural details have been carried out with great skill by Mr. C. A. de Boinville.

The staff of the College consists of a Principal and nine English Professors, assisted by Japanese teachers, and the Institution is under the jurisdiction of the Minister of Public Works.

A calendar of the College is published annually, which contains information relative to the admission of students, courses of study, and examination papers, as well as catalogues of the splendid collection of instruments in the laboratories, and of the books in the library, which seems to be exceptionally rich in almost every branch of general and scientific literature. C. W. C.

SUSPECTED RELATIONS BETWEEN THE SUN AND EARTH[1]

III.

IN the first of these articles I tried to show that the magnetism of the earth is affected by the state of the sun's surface. I shall now try to show that the meteorology of the earth is likewise affected by the same cause.

Mr. Baxendell, of Manchester, was, I think, the first to point out that the meteorological convection currents of the earth appear to vary according to the state of the sun's surface. More recently Mr. Meldrum, of the Mauritius Observatory, has brought this connection very forcibly before us by showing, from the results of his observations, that there are more cyclones in the Indian Ocean during years of maximum than during years of minimum sun-spots. This will be seen from the following table:—

TABLE II.

Comparison of the Yearly Number of Cyclones occurring in the Indian Ocean with the Yearly Number of Spots on the Sun.

Character as regards Sun-spots.	Years.	Total number of Cyclones.	No. of Cyclones in max. and min. Periods.	Character as regards Sun spots.	Years.	Total number of Cyclones.	No. of Cyclones in max. and min. Periods.
Max.	1847	5	23		1862	10	
	1848	8			1863	9	
	1849	10			1864	5	
	1850	8			1865	7	21
	1851	7		Min.	1866	8	
	1852	8			1867	6	
	1853	8			1868	7	
	1854	4	13		1869	9	31
Min.	1855	5		Max.	1870	11	
	1856	4			1871	11	
	1857	4			1872	13	
	1858	9			1873	12	
	1859	15	39				
Max.	1860	13					
	1861	11					

Prof. Poey has confirmed this conclusion of Mr. Meldrum by showing that there is a similar periodicity as regards the cyclones which make their appearance off the coast of Central America.

In the next place Dr. Arthur Schuster has found that the years of minimum sun-spots coincide very nearly with the good wine years in Germany. This will appear from the following table.

TABLE III.

Exhibiting the near Coincidence between the Years known as good Wine Years in Germany and the Years of minimum Sun-spots.

Dates of Minimum Sun-spots.	Years known in Germany as good Wine Years.
1784·8	1784
1798·5	(?)
1810·5	1811
1823·2	1822
1833·8	1834
1844·0	1846
1856·2	1857
	1858
1867·2	1868

Again, it has quite recently been remarked by Dr. Hunter, Director-General of Statistics to the Government of India, that the famines in Southern India have a period of recurrence which is nearly eleven years, being thus of the same duration as that of sun-spot frequency.

[1] Continued from p. 28.

Here we have evidence from various quarters of a connection of some sort between the state of the sun's surface and the meteorology of the earth, and it becomes a question of great interest what is the nature of this connection.

In the first of these articles a diagram was exhibited showing the close relation that exists between the state of the sun's surface and the range of oscillation of the magnet freely suspended at the Kew Observatory. If instead of taking the daily magnetic ranges we take the daily temperature ranges, that is to say, the differences between the maximum and minimum thermometers, we find an apparent reference to the state of the sun in these also, inasmuch as these ranges appear to be greater at times

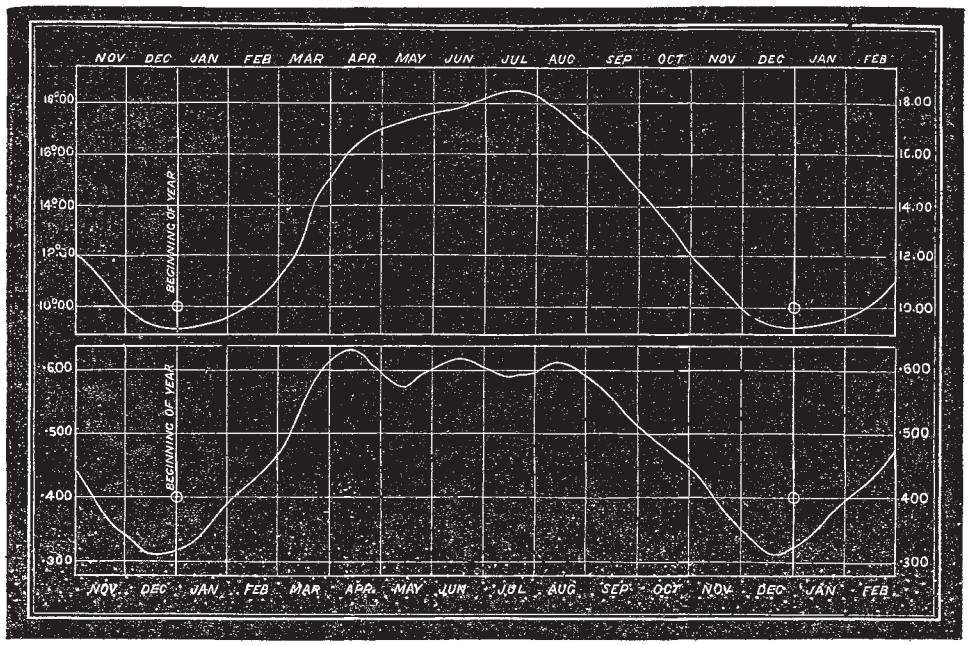

DIAGRAM K.—The Upper Curve denotes Temperature Range, the Lower Curve Declination Range.

of maximum than at times of minimum sun-spot frequency. Nevertheless the correspondence is not nearly so well marked as in the case of the magnetic declination, and there is no doubt much local irregularity. But here the following question of much interest and importance crops up. Do these fluctuations of the daily temperature range at the Kew Observatory coincide in point of time with the corresponding solar fluctuations? or do the former lag behind the latter, as is the case with the magnet? The practical bearing of this question is easily seen, for if temperature oscillations and other meteorological fluctuations are simultaneous with the corresponding solar changes, we can hardly expect that a study of the sun's surface will ever enable us to forecast meteorological occurrences; but if on the other hand the solar changes precede the meteorological ones, we may hope, when the nature of the connection between them is fully understood, to make use of solar observations in order to predict the greater meteorological occurrences. Now it appears to the writer that there are certain well-marked fluctuations of temperature range at the Kew Observatory which coincide very closely with corresponding magnetic fluctuations, and which therefore lag behind the solar fluctuations nearly six months (see Article I.); but this interesting and important question can only be determined by further investigations.

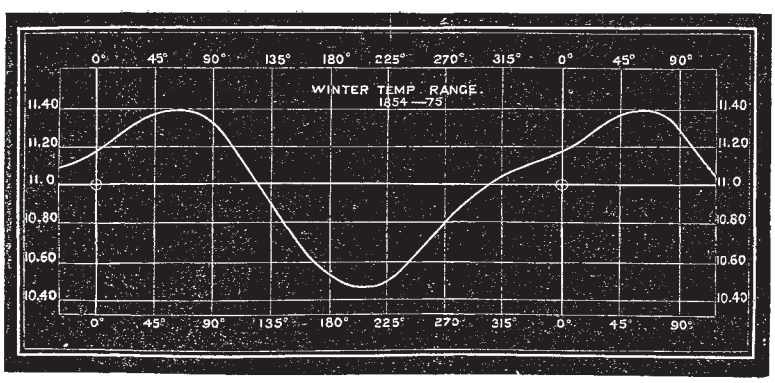

DIAGRAM L.

I may here remark that meteorologists are beginning to suspect a somewhat intimate connection between the magnetism and the meteorology of the earth. Mr. Baxendell was, I think, the first to point out that there is a diurnal inequality in the direction and velocity of the wind apparently connected with the daily changes of magnetic declination. On this subject the writer has recently received a letter from Mr. J. A. Broun, the well-known meteorologist and magnetician, who says, "My present opinion is that meteorological phenomena are due to solar actions; that the heating action is not the only one; but that the action which produces variations in the earth's magnetic force affects the conditions of the atmospheric gases, introducing forces which we cannot in the present state of our knowledge appreciate, though the facts appear to me to prove their existence."

It will be seen, by Diagram K, that there is a very

marked likeness between the annual variation of the temperature range and the annual variation of the declination range at the Kew Observatory.

There yet remains a question which is nearly allied to the present inquiry. If the sun affects the earth in a variety of ways, and if the planets affect the sun, why should not the moon affect the earth? Now it is known to affect terrestrial magnetism, producing a well-marked variation of a tidal nature, that is to say with two maxima and minima in each lunar day, and there are also indications of a variation with only one maximum and minimum.

Again, Mr. Park Harrison was the first to point out that terrestrial temperature is influenced by the relative position of the sun and moon.

The writer of this article has found in the daily temperature range at the Kew Observatory an unmistakable reference to the phase of the moon.

In summer when the full moon is low in the heavens, we have a less decided reference, which seems to imply a maximum of daily temperature range about new moon and also about full moon. But in winter, when the full moon is high, we have a very decided reference showing a maximum of daily temperature range about new moon, and a minimum about full moon.

Again, in the magnetic ranges at Kew the same features occur, namely, in summer a maximum range at new and at full moon, and in winter a maximum at new and a minimum at full moon.

The winter lunar variations of the temperature and declination ranges at Kew are exhibited in the Diagrams L and M, from which it will be seen that there is a very decided likeness between the two.

These last diagrams are especially interesting because they exhibit an influence which appears to be similar *in form* to that which the planets may be supposed to produce upon the surface of the sun. This, however, is a question which can only be decided by further investigation.

If we now bring together the results of these three papers we may compare the three problems, solar research, terrestrial magnetism, and meteorology, to three corners of a triangle that are bound together. Of their three relations we are, it may be said, perfectly certain of the connection between solar research and terrestrial magnetism. The connection between solar research and meteorology is perhaps not so well defined, but our evidence is here supplemented by independent traces of a connection between magnetism and meteorology. Thus the three things hang together, and scientific prudence points to the desirability of their being studied together as a whole, a consideration which will not, I trust, be overlooked in the contemplated reorganisation of British meteorology.

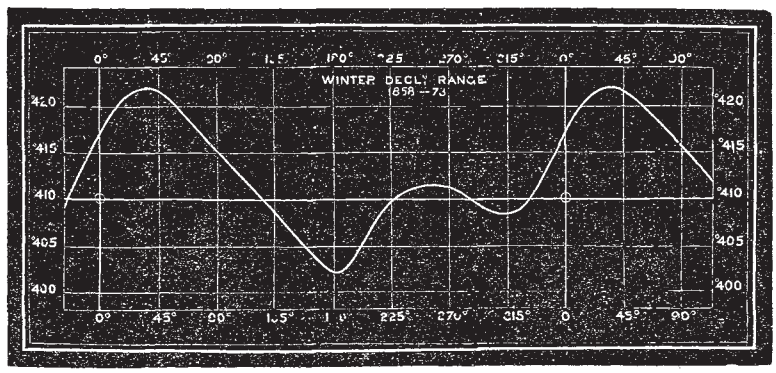

DIAGRAM M.

I would desire now to conclude by asking, in all honesty, Have we not here a plea for the establishment of some institution that will keep a daily watch upon that luminary which is thus seen to affect us in such a variety of ways?

BALFOUR STEWART

THE SOUTH AFRICAN MUSEUM

OUR notice of the condition of the South African Museum, and the various sums allotted to research by the Government of the Colony, has called forth some criticisms on the part of the Cape-town *Standard and Mail* of April 7. "What NATURE and other scientific organs in Europe mean by 'research,'" it states, "is not what the responsible advisers of the Cape mean by their favouring grants. It would not be saying too much, nor putting it too strongly, to assert that there is no scientific research carried on in connection with any botanical gardens in South Africa. In regard to our museums there is some genuine work being done; at all events in the South African and Albany museums original observations are being recorded. As to our libraries which absorb 2,000*l.* per annum of the public money, the less said, perhaps, the better. The South African Library, as far as standard works in such branches of science as anatomy, chemistry, mineralogy, natural philosophy, &c., are concerned, is simply deficient, and unaccountably so, considering the demands of these departments and the standing of some of the directors. The only sums voted for purely original scientific work are those for 'Geological Researches,' for the publication of Dr. Bleek's Bushman Researches, and for the Meteorological Commission. With the exception of the first of these, which amounts to 1,500*l.*, research in the sense NATURE must mean, is fostered by only some four or five hundred pounds." The writer then goes on to describe the consequences of Dr. Bleek's death; the linguistic and ethnological researches he was carrying on have been stopped, and instead of appointing a qualified scholar to fill his place, the Government allowed his office and salary "to be absorbed into the general and ignoble management of the South African Library, which is only a representative of Mudie, being conducted in the charitable idea of providing, at three pounds sterling per annum, the current literature of the day to subscribers who for the same reading would have to pay in a circulating library about four times the amount. . . . 'Novels are the solace of my life,' was the plea (of Mr. Goodliffe) from the chair in favour of continuing a national institution subsidised by the Government of the Colony, and therefore supported from the revenue of the country, as a receptacle for the custodianship of the popular writings of the period. The scientific work of South Africa has been done by amateurs holding no professed natural history appointments." The Gill College Herbarium now receives a subsidy of 100*l.* a year, but "Prof. Macowan worked at the botany of the Colony for thirteen years before he received any grant to enable him to prosecute the study, or to cover the expenses of preserving a large herbarium." The Colonial Herbarium in Capetown "has a collection of types of the very highest value to Cape botany—those arranged and classified by Dr. Harvey. It has the collections of Dr. Pappe, the late Colonial botanist, consisting of thousands of species, which were bought by a former Government for some 200*l.* Other collections more or less valuable are also in the Herbarium." But